



## Dispersed Permian megaspores from Rajmahal Basin, Jharkhand

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### General Note



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### ABSTRACT

The present communication deals with the study of some dispersed megaspores from the Barakar Formation, Rajmahal Open Cast Mine, Coal Mine Zone- 54. The spores mainly belong to genus *Biharisporites*. Since they are meagre and in dispersed condition therefore, identification at species level is not documented here. The present find reflects the existence of pteridophytes mainly lycopsids in the area and spines on their exosporium represent aquatic fresh water condition during their deposition.

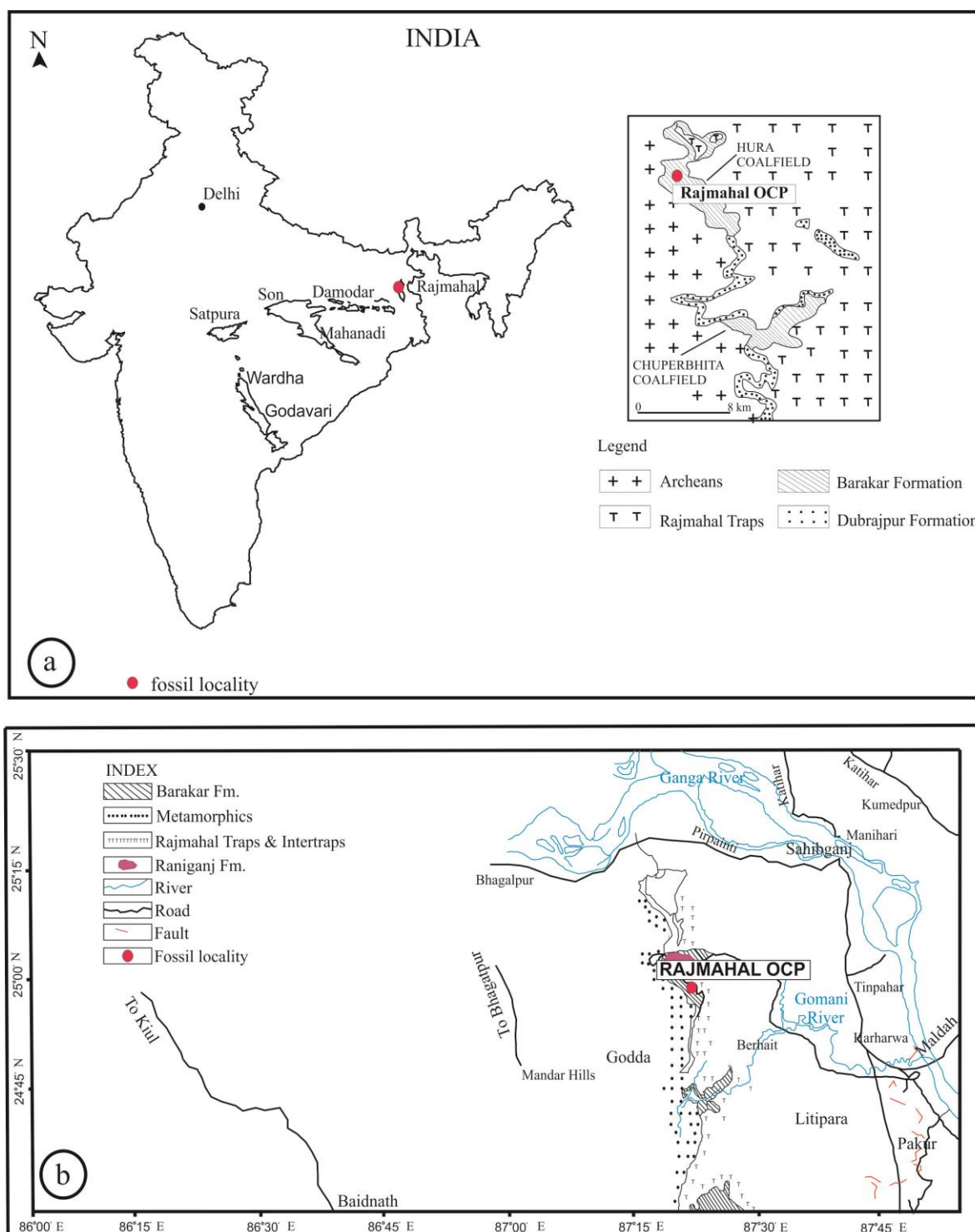
**Keywords:** Dispersed, Megaspores, Rajmahal Basin, Lycopsids, Deposition

### 1. INTRODUCTION

Presence of both micro and megaspores in the life history of plant termed as heterospory (Bateman & Dimichele, 1994). Microspores usually occur in abundance in comparison with megaspores and megaspores gives rise to the female gametophyte in

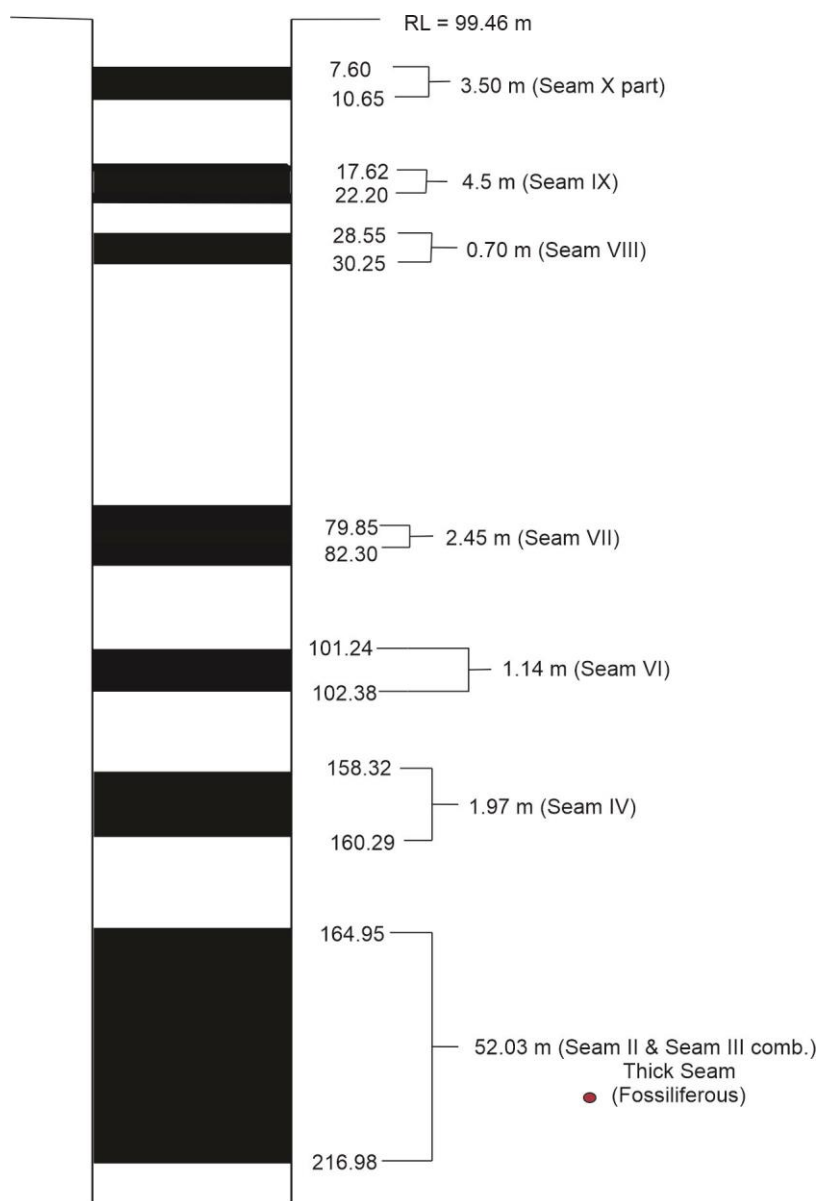
the early land plants mainly lycopsids. Here in the present study some dispersed megaspores mainly belong to *Biharisporites* sp. A (Tewari et al. 2009; Joshi & Tewari, 2015) are described from the Rajmahal Basin, Jharkhand and it is first record of megaspores from this particular coal mine zone (54). Earlier a new megaspore species had been recovered from the Coal Mine Zone-57 (Joshi, 2018). Hence, the present finding is important to understand the evolutionary history of the early land plants mainly lycopsids in the area during their deposition.

## 2. MATERIAL AND METHODS



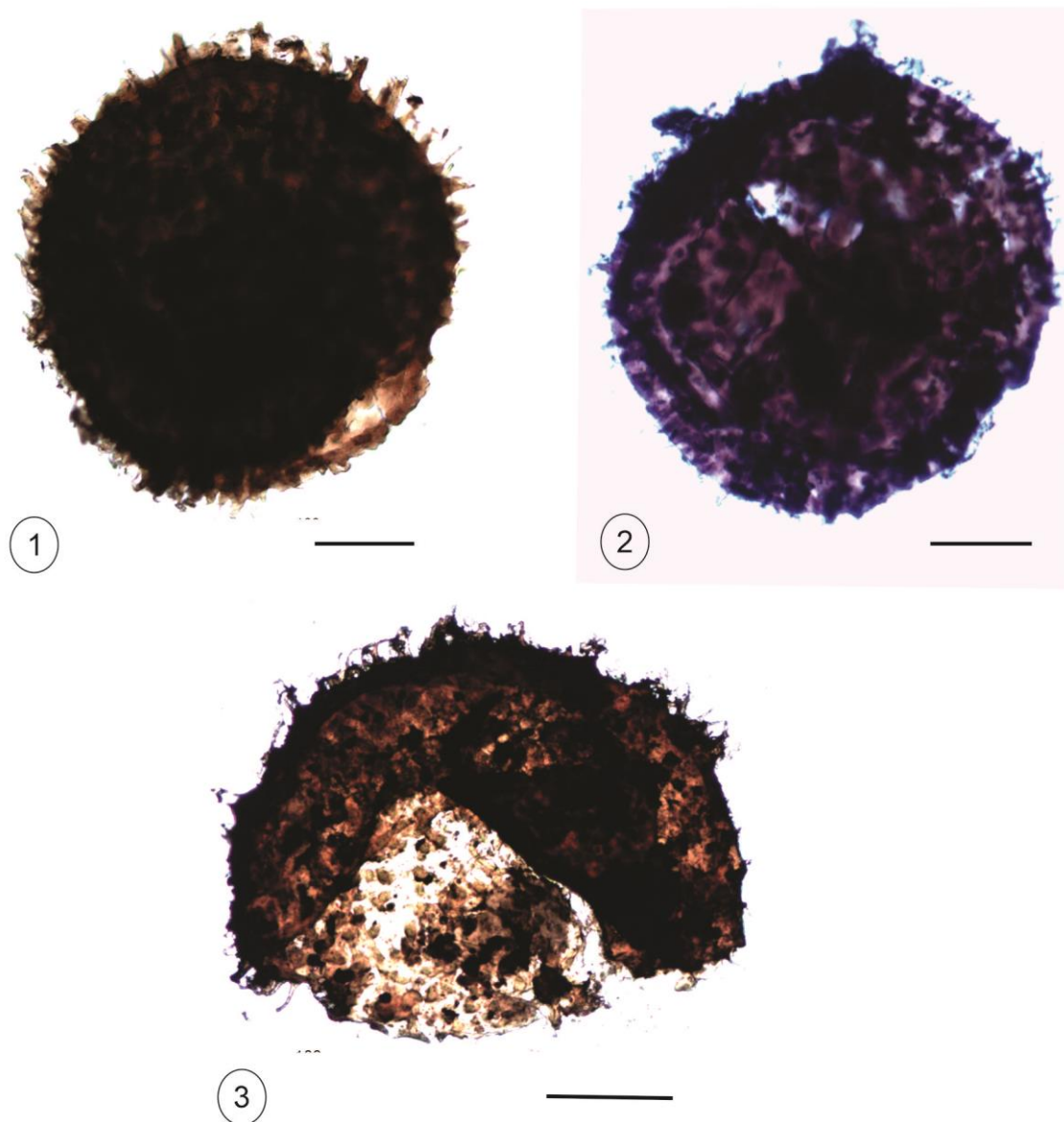
**Figure 1** (a) Map showing fossil locality (after Eastern Coalfields Limited). (b) Geological map of the study area

For the recovery of megaspores the carbonaceous shale samples collected from the Barakar Formation (Thick Seam), Rajmahal Open Cast Mine, Coal Mine Zone- 54, Rajmahal Basin, Jharkhand (Figs 1 & 2) were treated with bulk maceration technique in which the shale samples were broken into small pieces with the help of mortar and pestle. The pieces were kept in the maceration jars with concentrate hydrofluoric acid for 5–7 days when the samples turned into fine slurry. Then washed the samples thoroughly with water and sieved. Megaspores were picked one by one and kept in conc.  $\text{HNO}_3$  for about half day. Additionally, add small amount of  $\text{KClO}_3$  to enhance rate of the reaction. When the megaspores were appeared brown, they were again thoroughly washed with water. The picked megaspores were differentially macerated with 5% potassium hydroxide (KOH) solution which revealed the different ornamentations, shape, triradiate mark, contact ridges of exosporium. The microscopic study was done with the help of low power binocular microscope Olympus CH-20i. The slides are deposited in the Botany Department SGRR (P.G.) College, Dehradun.



**Figure 2** Litholog of the Rajmahal Open Cast Mine, Coal Mine Zone- 54, Rajmahal Basin (after ECL, 2017).

● = Fossiliferous (Megaspores).



**Figure 3** Scale bar = 100  $\mu$ m

*Biharisporites* sp. A; SGRR Slide no. RJ/54-a (2) *Biharisporites* sp. A; SGRR Slide no. RJ/ 54-b and (3) *Biharisporites* sp. A; SGRR Slide no. RJ/ 54-c.

### 3. SYSTEMATIC DESCRIPTION

**Genus:** *Biharisporites* (Potonié) Bharadwaj and Tewari, 1970

**Type species:** *Biharisporites spinosus* (Singh) Bharadwaj and Tewari, 1970

*Biharisporites* sp. A (Fig. 3. 1-3)

**Age:** Barakar Formation, Early Permian, Rajmahal Open Cast Mine, Coal Mine Zone- 54, Rajmahal Basin, Jharkhand, India.

**Diagnosis:** Megaspores azonate, oval (Fig. 3. 1,2) and half recovered (Fig. 3. 3), tri-radiate and arcuate ridges not clear, exosporium connate/spinate, coni/ spines more distinct on margin, dark circular, mesosporium occupying 1/3 of spore cavity is present in two spores (Fig. 3. 1,2). One spore ruptured (Fig. 3.3), seeing hyaline mesosporium without cushions.

**Dimensions:** Their size ranges 431 x 924  $\mu$ m, length of spines 45–65  $\mu$ m, width of spines at base 31–45  $\mu$ m, width of spines at apex 13–19  $\mu$ m, diameter of mesosporium 351 x 650  $\mu$ m.

**Remarks:** Megaspores are identical (except Fig.3.3; half recovered; identical in terms of spines on exosporium) in shape, nature of exosporium and mesosporium to *Biharisporites* sp. A recorded from late Permian of Ib River Coalfield, Mahanadi Basin, Odisha

(Tewari et al. 2009, Fig. 3.15) and Index Seam, Goutham Khnai Open Cast Mine, Kothagudem Area, Godavari Graben, Telangana (Joshi & Tewari, 2015, Pl. 1.3).

**Slides:** SGRR Slide nos. RJ/54-a, RJ/ 54-b and RJ/ 54-c.

#### 4. CONCLUSION

Occurrence of such spinate *Biharisporites* megaspores though rare, point towards aquatic conditions (Tewari et al. 2009). Megaspores are female gamete cells found in megasporangium of pteridophytes which is an advance character during the evolution of land plants mainly lycopsids. The exosporium ornamented with different kinds of spines, setae and reticulum reflects on the diversity of the parent plants (Pillai et al. 2016). Presence of these dispersed megaspores adds to the existing knowledge of megaspores in the Rajmahal Basin. The dense spinate megaspores point toward favourable environmental conditions i.e. aquatic fresh water condition for the germination of the megaspores (Joshi & Tewari 2015; Joshi, 2016, 2018; Agnihotri et al. 2018). Although the present record is scarce however, significant represent the depositional environment better suited for the growth and development of such diversified parent plants mainly lycopsids. Therefore, more efforts are required for the better retrieval of megaspores in the area for better understanding of the biostratigraphy and depositional environment.

#### Disclosure statement

The author declares that there is no conflict of interest.

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#### Conflicts of interest:

The authors declare no conflict of interest.

**Peer-review:** External peer-review was done through double-blind method.

**Data and materials availability:** All data associated with this study are present in the paper.

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